Putting a Stop to Hot Work Losses

There's no excuse for hot work fires. All are preventable. With rare exception, human error is the root cause. Ironically, more information is available today then ever before on how to manage the activities of personnel doing hot work. And U.S. government agencies have imposed heavy fines on those found guilty of committing violations leading to losses.

Despite this, costly hot work losses continue (see Table 1). Investigations point to one thing: facility managements' failure to take responsibility for hot work that their own employees or outside contractors perform on their properties.

Cutting, grinding, brazing, welding, soldering, thawing pipe, applying roofing materials with torches—all examples of hot work—involve open flames, sparks or heat. A flame from an oxyacetylene cutting torch can reach up to 6,000°F (3,316°C). Sparks can fly or roll great distances and ignite combustible storage, dust accumulations or oily residues. Smoldering material hidden from sight can suddenly burst into flame long after work is completed and personnel have left the area. Heat conducted by hot work on one side of a wall can ignite combustible material on the other side.

Hot work continues to be the third leading ignition source of fires and explosions at properties insured by Allendale Insurance, Arkwright and Protection Mutual Insurance. During the past 10 years, hot work losses totaled approximately $1.6 billion; contractor negligence accounted for more than half the cost of those losses.

Some contractors think they know all the precautions because of their familiarity with the work itself. Others are unwilling to take responsibility for protecting someone else's property. Even when effective hot work programs are in place, contractors will sometimes ask facility management to lighten up on permit policies. In some cases, contractors have convinced management to sign ''hold harmless'' agreements, which hold the facility responsible for losses caused by the contractor.

Regardless of who causes the problem—outside contractor or employee—the entire responsibility for successfully controlling all hot work on the premises belongs to those who manage the facility or property.

Managing hot work means preventing all hot work losses and having absolute control over all hot work activities.

Setting up a hot work program is easy, but, given the loss history, making sure the program is followed apparently is not. For insureds who need help setting up a program, complete hot work guidelines and a *Hot Work Permit System* wall kit are available free from your Factory Mutual (FM) or Factory Mutual International (FMI) loss prevention consultant.

Management policy

A written management policy on hot work is essential. It sends a signal to all employees that proper hot work is a top priority with management.

Table 1. 1990-1994 Million-Dollar Hot Work Losses

Estimated Gross Loss	*Probable Cause*	*Contributing Factor*
$59 million	cutting/welding	permit provided but not used; employee negligence
$56 million	acetylene torch	automatic sprinklers not in service, building idle; contractor negligence
$46 million	cutting/welding	sprinkler system unavailable; contractor negligence
$31 million	acetylene torch	fire shielded from sprinkler; contractor negligence
$15 million	cutting/welding	no permit system; employee negligence
$11 million	cutting/welding	sprinklers needed; employee handling a light torch
$ 5 million	acetylene torch	no operating procedure available; exposure to class I flammable liquid; contractor negligence
$ 5 million	plumbers/painters torch	sprinkler system unavailable; exposure to class III flammable liquid
$ 5 million	cutting/welding	sprinklers needed; contractor negligence
$ 5 million	plumbers/painters	water supply inadequate; employee handling a light torch
$ 3 million	brazing torches	sprinklers needed; employee negligence
$ 3 million	cutting/welding	Emergency Organization inadequate; contractor negligence
$ 2 million	acetylene torch	sprinkler system unavailable; contractor negligence

In the policy, list the ground rules for the hot work program, clearly stating where (designated areas) and how (under what conditions) hot work may be performed. Describe the chain of command for enforcing hot work procedures extending from management to firesafety supervisors, to the Emergency Organization (EO) to maintenance crews and contractors. Include a contractor violations statement that puts contract personnel on notice that they will be monitored for infractions, and that infractions will result in disciplinary action. State that employees and contractors are equally responsible for obeying the policy.

Once a policy is in place, management is responsible for following through with a solid program. Employee training is critical to managing hot work operations. Provide a complete training program for employees who perform hot work. This includes training the designated fire watch to use fire extinguishers and hose and to sound the alarm in case of fire. Instruct workers to conduct the work within the time frame authorized, to use the hot work permit properly, and to obey the instructions of the firesafety supervisor appointed to supervise all hot work on the premises.

Controlling contractors' activities is critical in preventing losses. Do not assume a contractor's ability to modify buildings or equipment extends to knowledge about loss prevention. Make sure requirements for contractors' credentials and experience, and adherence to a company's hot work policy reflect a high standard of workmanship and compliance to all hot work procedures. Make sure contractors read, understand and sign all agreements to comply with the company's hot work program.

Modify the wording of contracts as needed to prevent any contractor from misinterpreting the intent of the contract. In the contract, specify that no ''hold harmless'' agreements will be signed and that any contractor who refuses to follow company procedures will be escorted off the premises.

Communicating with contractors before they arrive on the premises is another essential part of managing hot work. At least one week before outside contractors are scheduled to begin work, send them a letter describing their responsibilities and your hot work rules. (See sample letter on page 12). State that hot work cannot be performed without a permit issued by the facility's firesafety supervisor. Inform contractors that nothing less than 100 percent compliance will be tolerated, and that they will be asked to leave the premises upon the first violation of a warning. Send similar letters or memos to employees conducting hot work, stating the disciplinary consequences for violations.

One way to discover a contractor's attitude toward following hot work precautions is to ask the contractor's management if they train their employees via regular seminars or workshops, and, if so, what topics are covered in the seminars. Avoid contractors who do not train their own employees in the latest jurisdictional requirements applicable to their tasks.

FM's *Hot Work Permit System* wall kit is the heart of a hot work program. Any temporary operations involving open flames or producing heat or sparks requires a permit.

Sample Letter to Contractors

Contractors Hot Work Information and Responsibilities

Welcome to _____ Company

Our company strongly believes that fires caused by hot work can have a significant adverse effect on our ability to do business. Because of this, we have established procedures and trained our employees to help minimize this hazard.

As a contractor at this facility, you are a partner in our continued success in preventing losses. We encourage your suggestions on how hot work can be avoided by using alternative methods. If hot work cannot be avoided, you are expected to strictly follow our procedures.

_____ , the firesafety supervisor, will help you follow our procedures for hot work. If appropriate, the supervisor will introduce you to other workers in the area to discuss unique conditions you should be aware of before your work begins.

Please read our company's hot work rules, and thank you for helping us to improve our property and protect against loss.

Sincerely,

Options to hot work

Hot work should not begin until employees are trained properly and contractors are made fully aware of management policy. And before authorizing hot work, investigate other options. Can the job be done with a handsaw, pipe cutter or other such equipment? Can all combustibles be removed from the hot work area, or can the work be moved?

If the area cannot be made safe for hot work, prohibit hot work.

Allow no hot work in any area where the following conditions exist:

- Adequate precautions cannot be taken.
- Flammable liquid processes cannot be shut down.
- Lint or dust conditions are severe, beyond immediate correction
- Flammable vapors are in the air, or the atmosphere is otherwise potentially explosive.
- Large amounts of combustibles such as roll paper, cottons or jute storage cannot be moved or covered.

In addition, avoid hot work on combustible walls or ceilings, and in areas where concealed spaces exist.

Before starting any hot work job, check automatic sprinkler protection to be sure equipment is in service and is fully operational. Also check to make sure all hot work equipment is in good repair, especially hose attachments. Hose leaks can be particularly hazardous on torch cutting and welding equipment because a flammable gas leak could become a potential ignition source.

Issuing the permit

Assuming the work area is safe, the firesafety supervisor issues the permit to authorize the job. If FM's permit is used, then the following items are completed on the permit (Part 1):

- person doing the job (employee or contractor)
- date of job and job number
- location of work
- nature of job
- name of person doing hot work
- date and time of expiration

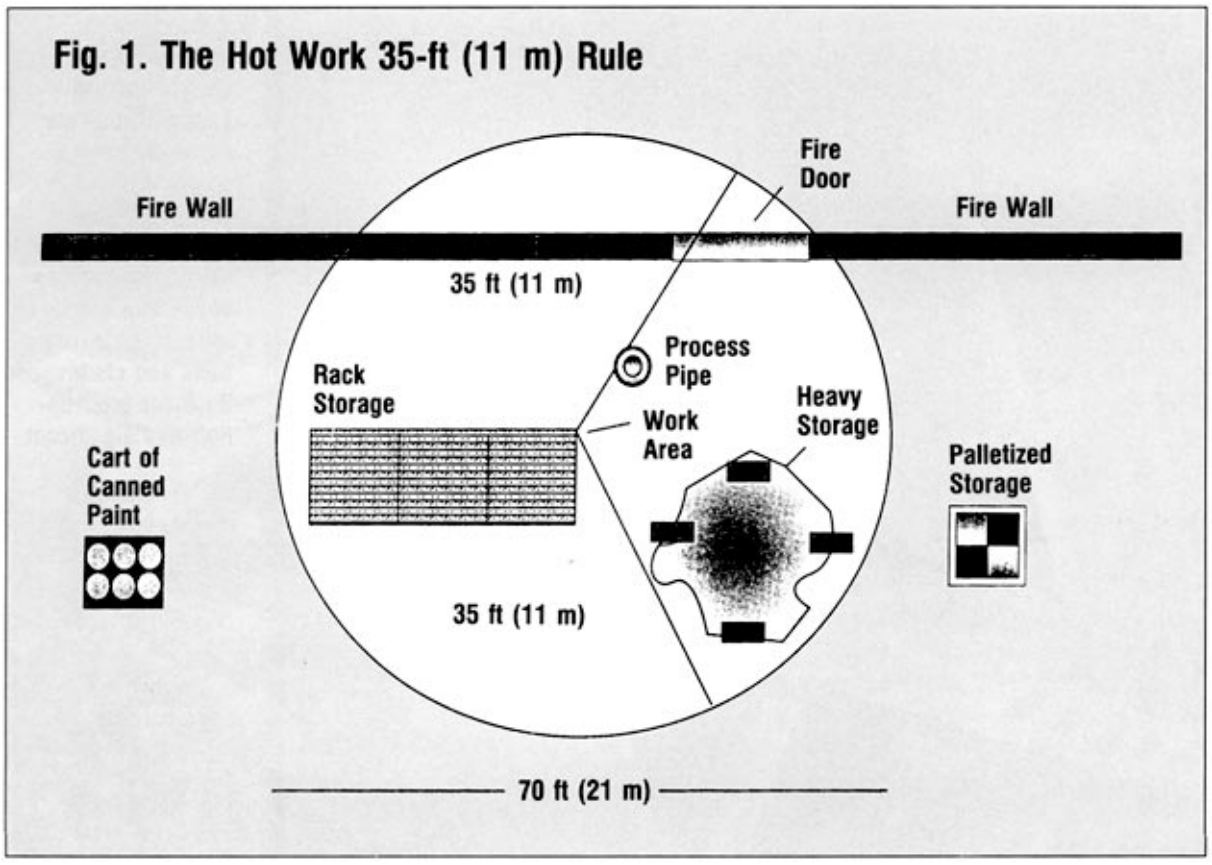
The person doing the hot work then hangs the completed permit in a visible place in the work area. FM's *Hot Work Permit* expires at the end of each shift or eight hours, whichever is shorter. A new permit has to be issued for each shift thereafter.

The permit checklist requires a minimum clearance of 35 ft (11 m) surrounding the hot work site (see Fig. 1). Expand this to 50 ft (15 m) if flammable or combustible liquids are present.

An alternative to this rule is to designate a separate, screened-off hot work area to prevent sparks from escaping. Ensure the area is built of noncombustible construction, and keep it completely free of nonessential combustible materials.

Within the 35-ft (11-m) area, do the following:

- Remove flammable liquids such as paints, oils and lacquers from the work area. Simply sealing their containers is not sufficient.



- **Remove or shield from sparks all potential fuels within 35 ft (11 m) of the work area. In this case, the paint cart and palletized storage.**
- **Empty racks on which the work is to be done of all storage.**
- **Close fire doors and seal floor openings such as the area surrounding process piping with an FMRC-Approved fire-stop material.**
- **Cover heavy combustible storage that is impractical to move with a fire-resistive tarpaulin.**

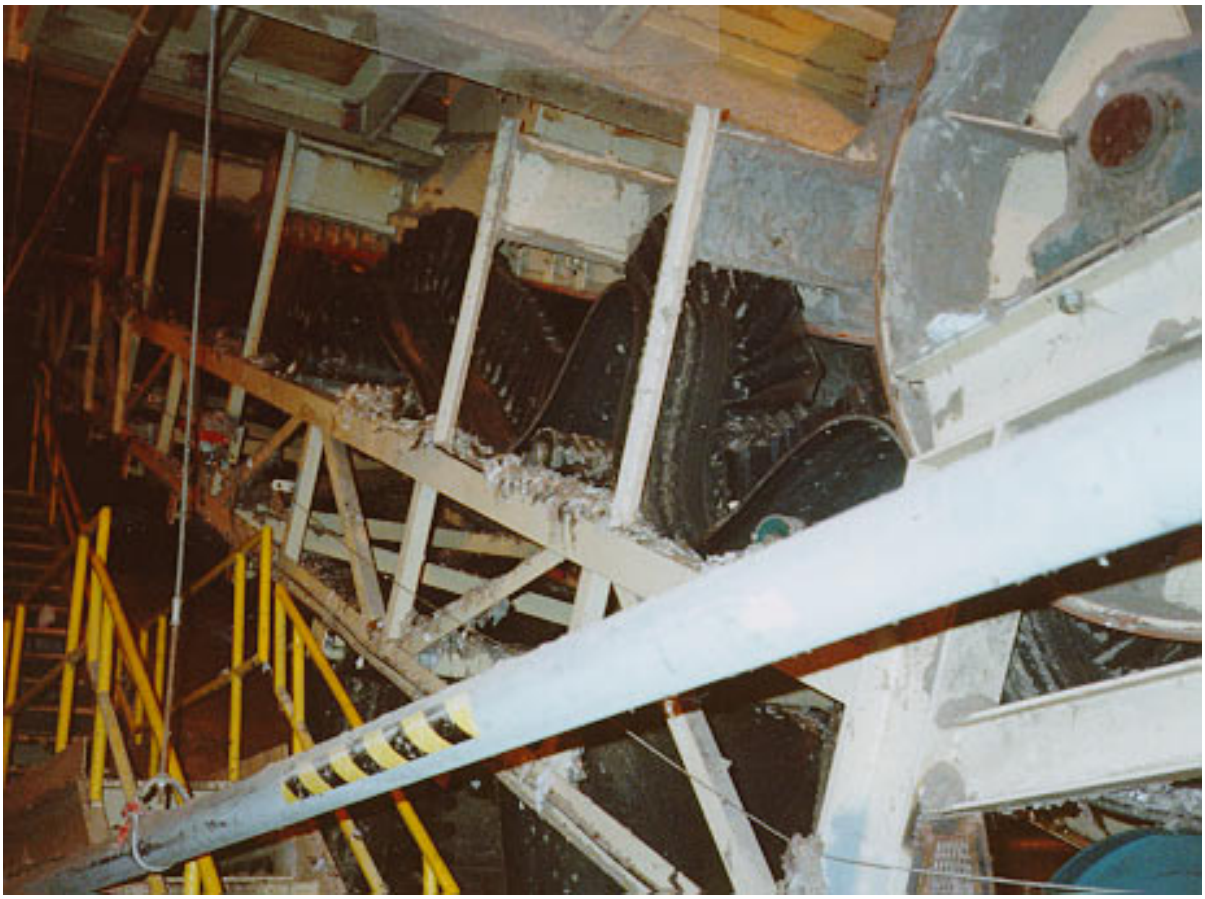
- Sweep floors clean. Clean up and remove grease and oils. Do not simply soak these up with sawdust and leave the sawdust in place. This reintroduces a combustible hazard.
- Cover combustible floors (e.g., plank-on-steel, wood block) with fire-resistant tarpaulins or other noncombustible material.
- Cover openings in walls, floors or equipment where a spark could enter.
- Cover equipment that involves rubber lining, combustible residues, combustible interiors or combustible process material inside.
- Protect ceilings exposed to hot work. Use fire-resistive tarpaulins and suspend the tarpaulins under any work performed near ceiling areas. Place noncombustible screens around work at the floor level to trap sparks.
- Move combustibles away from the opposite sides of walls, ceilings or floors where hot work is performed. Take other precautions needed to prevent welding operations from radiating or conducting heat to unobservable combustibles.
- Remove all storage from racks on which work is to be done.
- Use fire-resistive tarpaulins or metal shields to protect combustibles that cannot be moved, including storage or machinery with grease or lint deposits.
- Plug floor openings with a Factory Mutual Research Corporation-Approved fire-stop material.
- Seal ductwork and duct openings with metal covers built for the vents, or cover such openings with fire-resistive tarpaulins. (Ductwork is dusty and can circulate dust through a facility as it circulates air. Ductwork might also have combustible coverings or insulation.)
- Close all doors and fire doors to prevent sparks from escaping.
- Check for combustible coverings and insulation on walls, partitions, ceilings, roofs, panels of sandwich-type construction, or any surface where welding is planned.

If hot work is performed on enclosed equipment, clean the equipment of all combustibles, and purge containers of flammable liquids and vapors.

As hot work is being performed, a fire watch stands beside the person performing the hot work, keeping a constant vigil for stray sparks and possible ignition. The fire watch monitors the area continuously for combustible gas accumulation before, during and after the hot work; checks adjoining areas including areas above and below hot work; halts any process that produces explosive atmospheres; and stands ready to provide initial fire response.

The fire watch remains in the work area for one hour after the work is done to check for smoldering fires. This person signs the permit and leaves it posted. The firesafety supervisor, or designee, monitors the area for an additional three hours.

At the end of the monitoring period, the supervisor or designee reinspects the work area, including



A welder was installing a door on the splitter (an enclosed multiple conveyer transfer point). A small, glowing fire near the splitter ignited fuel inside the conveyer. Fire spread to the rubber conveyer belts and chutes. Business interruption was significant.

all adjacent areas and rooms, and the floors above and below for smoldering fires. If these areas are safe, the supervisor or designee signs the permit, removes it from the area and keeps it as a record of work.

Permits should be returned to the person who manages firesafety responsibilities. Any unusual incident that happened during the monitoring period should be reported to management so corrective action can be taken.

Expanded awareness

Facility management needs to raise its awareness of those times when a facility is most vulnerable to hot work losses. A facility is at higher risk, for example, when a recent change has occurred such as construction, or an installation, repair or modification to buildings or equipment. An operation might have been upgraded or the sprinkler system impaired. When these changes are occurring, management's usual attention to hot work precautions is likely to be diverted, and hot work contractors might not receive the necessary level of attention.

Certain occupancies are also at higher risk for hot work losses, according to FM statistics. Metal working or mineral, food processing, pulp and paper processing, textile processing, woodworking, mining and grain handling are examples.

Management can also enhance employee awareness of hot work by conducting an ''awareness'' check. Ask employees who normally conduct hot work on the premises or supervise outside hot work contractors, the following questions:

1. Who is responsible for overseeing hot work?
2. Are your co-workers generally aware of the hazards created by hot work and would they immediately report any unsafe process they noticed to management?
3. What management control is used to make sure personnel follow the company's hot work permit system and the 35-foot (11-m) rule?
4. Which areas can be used throughout the facility for hot work based on fire potential? Which are forbidden?
5. What management control is used to verify that all welders, cutters and supervisors are fully trained in the safe operation of their equipment?
6. What written instructions are provided to outside contractors about hot work permit requirements?
7. Are fire protection and extinguishing equipment accessible from hot work areas? Is this equipment checked regularly to ensure it is in good repair, and is properly rated, charged and certified?
8. Are compressed gas cylinders properly secured and standing upright when being used or stored?
9. Have changes such as an impaired sprinkler system, new or changed processing, new construction, new equipment, reorganization, new personnel, or increased contractors on the premises ever compromised the hot work policy? If so, in what way? How was this corrected?
10. What is the loss history of the facility? If any losses involved hot work, what recommendations resulted? What management decision was

A fire started by a cutting torch burned all goods stored in this dockside warehouse and severely warped the building roof steel. A small fire hose was too short to reach the fire in its early stages. Sprinkler protection was lacking and fire spread rapidly throughout the building due to the highly combustible nature of the rolled paper, newsprint, pulp and lumber products.

made to improve the hot work program as a direct result of the loss lesson?

11. What is the housekeeping policy at the facility? Have poor housekeeping or equipment repairs ever been associated with past losses?
12. What documentation pertaining to hot work safety are contractors required to sign before beginning work?
13. What do you know about losses resulting from contractor negligence at the facility? Was the probable cause due to:
    - — lack of awareness
    - — existing procedures not followed
    - — contractor assumed to be an expert
    - — lack of familiarity with property (contract work was infrequent)
    - — frequency of contract work produced complacency
    - — discipline for infractions was light
14. Do any of the contractors you work with show signs of having the following problems?
    - — attitude (''It won't happen to me.'')
    - — ignorance of precautions
15. Are contractors aware of
    - — company hot work policy
    - — level of management commitment
    - — specific risks on the property
    - — recent changes
16. Do contractors demonstrate a high degree of commitment to:
    - — company's hot work policy
    - — hot work permit procedures
    - — 35-ft (11-m) rule
    - — regular review of precautions and periodic retraining

The above questions should not only be asked of employees, but of facility management as well. Management-level personnel should also ask themselves the following:

1. Do I have a double standard for contractors and employees such as:
   - — employee carelessness cannot be tolerated but some carelessness is expected of contractors, or vice versa
   - — quality work and timely completions are expected more of employees than contractors, or vice versa
2. How do I respond to contractors who attempt to lower the standards set forth in the company policy or the contract?
3. Do I keep a record of contractor's qualifications in the following areas?
   - — performance track record
   - — experience in scope of work
   - — resources (manpower and equipment)
   - — safety record
   - — employee training

It's clear that hot work losses will continue until facility management takes full responsibility for hot work performed on-site, whether by their employees or outside contractors.